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The Tech.

VOL. III.

BOSTON, JAN. 16, 1884.

No. 7.

THE TECH.

Published on alternate Wednesdays, during the school year, by the students of the Massachusetts Institute of Technology.

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THE semi-annual examinations, with their train of attendant evils,—the sleepless nights and heavy gas bills,—have so far gone by that the coming short recess begins to take on the form of a visible reality. There is small need to say that it

will be appreciated, for holidays are at a premium at the Institute, if anywhere, and the term has been to most of us one of vigorous and protracted work. It is to be hoped—and doubtless will be the case—that the Faculty will find time during the recess to inquire into the foundation for the numerous complaints of over-work, and that the inquiry may result in some desirable changes.

THE children of the late B. S. Rotch have established, in accordance with their father's wishes, a scholarship which is to be forever devoted to sending annually to Europe a student of architecture for a term of two years.

By this arrangement there will always be two students travelling and studying in the best schools abroad and supported by the scholarship. The beneficiaries of the fund are to be selected by competitive examination under the conditions set forth below, and the stimulus afforded by such a prize cannot fail to benefit all who enter the competition, while the value of the foreign study to the successful candidates and its good effect upon all American architectural work can hardly be over-estimated. The opening years of a young architect's career are hard ones at best; they are years when he must struggle along on insufficient pay and amid discouragements which often prove too much for him. An opportunity like the present one is too rare to be unappreciated, and for the benefit of architectural students in the Institute we give in full the circular sent out through its special committee by the Boston Society of Architects, which has been invited by the trustees of the fund to take charge of the examinations:—

General Regulations of the Travelling Scholarship for Students of Architecture founded by the late BENJAMIN S. ROTCH.

Examinations for the Rotch travelling scholarship will be held every year, and the successful candidate will receive from the trustees annually for two years \$1,000, to be expended in foreign travel and study: provided, always, that the beneficiary shows such evidences of diligence as may be required of him.

Candidates must be under thirty years of age, and must have worked during two years in the office of an architect resident in Massachusetts.

The committee of the Boston Society of Architects having in charge the examinations for the scholarship invite candidates to present themselves at the Boston Museum of Fine Arts, April 3, 1884, at 9 A. M.

A problem in design will be given to all candidates, and they will be required to make a preliminary sketch for it at the time. The authors of satisfactory sketches will be allowed one month for their development,—all the essential features of the scheme being retained,—into finished

geometrical drawings, rendered in color with projected shadows. An accurate perspective of the finished elevations must be drawn in line. The set of drawings must be accompanied by a thesis explaining the principles of architecture, historical and æsthetic, which governed the choice and development of the design.

The authors of the selected preliminary sketches will be required to pass examination in the following subjects:—

1. History of architecture, and the arts immediately connected with it.
2. Elementary knowledge of the French language.
3. Plain perspective, projections, shades, and shadows.
4. Construction, theory, and practice.
5. Freehand drawing from the cast.

The committee make the following suggestions for the help of students preparing themselves for examination:—

In history—Lübke's History of Art; Fergusson and Rosengarten's works on Architecture.

In the French language—To exercise themselves in reading at sight portions of Viollet-le-Duc's writings.

In perspective—The treatises by Prof. Ware and S. E. Warren; Ruskin's Elements of Perspective.

In construction—Familiarity with ordinary practical construction in wood, iron, and masonry, and computation of strength of materials.

Books of reference—Trautwine, Notes on Building Construction of the South Kensington series, Green's Graphics, and Prof. T. M. Clark's Building Superintendence.

Practice in freehand drawing—A six-hour study from the cast will be required.

E. C. CABOT.

T. M. CLARK.

C. A. CUMMINGS.

R. S. PEABODY.

ARTHUR ROTCH.

OUR attention has recently been called to the interesting sewerage experiment tried at the little city of Pullman, in the West, and the results shown by it are worthy of the attention not only of prospective sanitary engineers, but of all those who live in thickly settled communities. The town has a population of six thousand or more, and its entire sewage flows into a huge cistern beneath a tall tower, from whence it is pumped by steam power into a conduit and carried out to a prairie farm of fifteen hundred acres, which was formerly exhausted and barren land.

The sewage is here distributed by irrigation,—the land having been previously tile drained,—the solid parts being greedily ab-

sorbed by the earth to nourish the fruits and plants for the city; the liquids filtering through the soil and flowing into a neighboring lake.

The expense of thus treating sixty acres of land was eighty thousand dollars, from which land eighty-five hundred dollars were realized in fruits and vegetables the ensuing season.

Another example of this same system is to be found in a town of between five and ten thousand inhabitants on the outskirts of London, England, where the sewage is conducted away in a similar manner, making a valuable fertilizer. In this case the products were contracted for by the single owner of an extensive farm. No trouble was experienced in taking care of the entire quantity, and a well was shown, sunk to a depth of twenty feet or more, in which the water was clear and of good quality, the process of filtration having been so complete.

The drainage question is assuming a serious aspect in most of our large cities at the present day, and this method of disposing of it is eminently satisfactory so far as it has been tried. The *American Architect* makes an estimate on the sewage of Boston, and suggests that it furnishes the means of annually restoring to former productiveness the barren tracts of Southern Massachusetts,—from fifty to one hundred thousand acres.

The matter of expense is secondary, but then it would not exceed the enormous expenditures continually made by large cities, and with so poor success.

There have been objections raised to the system on the theory that the air would be filled with disease germs, or that poisonous properties would be imparted to growing plants and vegetables, but this has so often been refuted by scientists that it needs no further discussion here, and indeed would have no influence on intelligent minds. The many advantages are obvious, and where the drainage is complete there is no danger.

The idea is not a new one, but the credit of its present application belongs to the French, and we believe that its more general introduction is certain throughout the United States.

A Reminiscence.

Some several years or more ago,
When Jones served up unknowns
In the ancient gym., — his stock in trade
An oyster and other bones, —

We all believed, I am forced to say.
This mollusk was a myth,
Till once I ordered stews for five,
And caught it in the fifth.

Oh what a shout we fellows gave!
We bound it with a thong;
(’T was roast-beef day, you may surmise,)
It struggled hard and long.

We hustled in a camera,
Our Sam sustained his head;
The machine was fixed for spectrum work,
He took at the infra-red.

I never can forget that day, —
And I sit for hours and laugh
At the wrinkled smile that oyster gave
As he posed for his photograph.

I. W. L.

About Cantilever Girders.

THE attention of engineers has been of late so strongly turned towards the subject of cantilever girders by the successful completion of the great bridge across the Niagara River just below the Falls, and the statement has been so often made that this structure is the first of its kind which has ever been built, that the readers of THE TECH may be interested in a few words of explanation regarding cantilever girders in general and the different structures which have thus far been constructed upon this principle.

The simplest kind of bridge — the so-called *simple girder* — is supported only at its two ends by vertical forces. If there are several openings to be spanned in succession, the bridge over each one is entirely independent of those on either side of it; resting on the same piers, but not being connected with them in any way. But engineers soon came to see that if several openings were to be crossed a saving of material might in some cases be effected by making a structure which should be continuous over several openings, — a so-called continuous girder.

Such a girder not only effects a saving of ma-

terial, in the case of long spans, but in some cases it is much easier to put it in place, as it can be built on shore and pushed out over the piers; or, one span being erected on scaffolding, the others may be built out piece by piece, the weight of the span first erected serving as a counterpoise to balance the projecting part, dispensing in either case with most of the false works which are necessary in the erection of a simple girder; and it might be even possible for one of the piers to be washed away without carrying away the bridge, which might remain supported by the piers adjacent, while under these circumstances two spans of a simple girder would be carried away. But the continuous girder has some very grave disadvantages, and one of them will easily be recognized by considering the point just referred to; for it is evident that if one of the piers should settle sufficiently it might throw all of the weight which it previously supported upon the other piers; or, in other words, it might sink so far as to clear the girder entirely. Under these circumstances it is plain that the bridge could not bear as great a load as it previously could, because of two of its spans being thrown into one. We see, therefore, that the continuous girder is liable to have the forces which act in its different parts very greatly changed by circumstances over which we have little or no control, and it may be shown by calculation that a very small settling of one of the piers may change the calculated forces by a very large amount. We can never be sure, then, just how much a bridge of this kind can safely bear, — we are to a certain extent in the dark as to its strength.

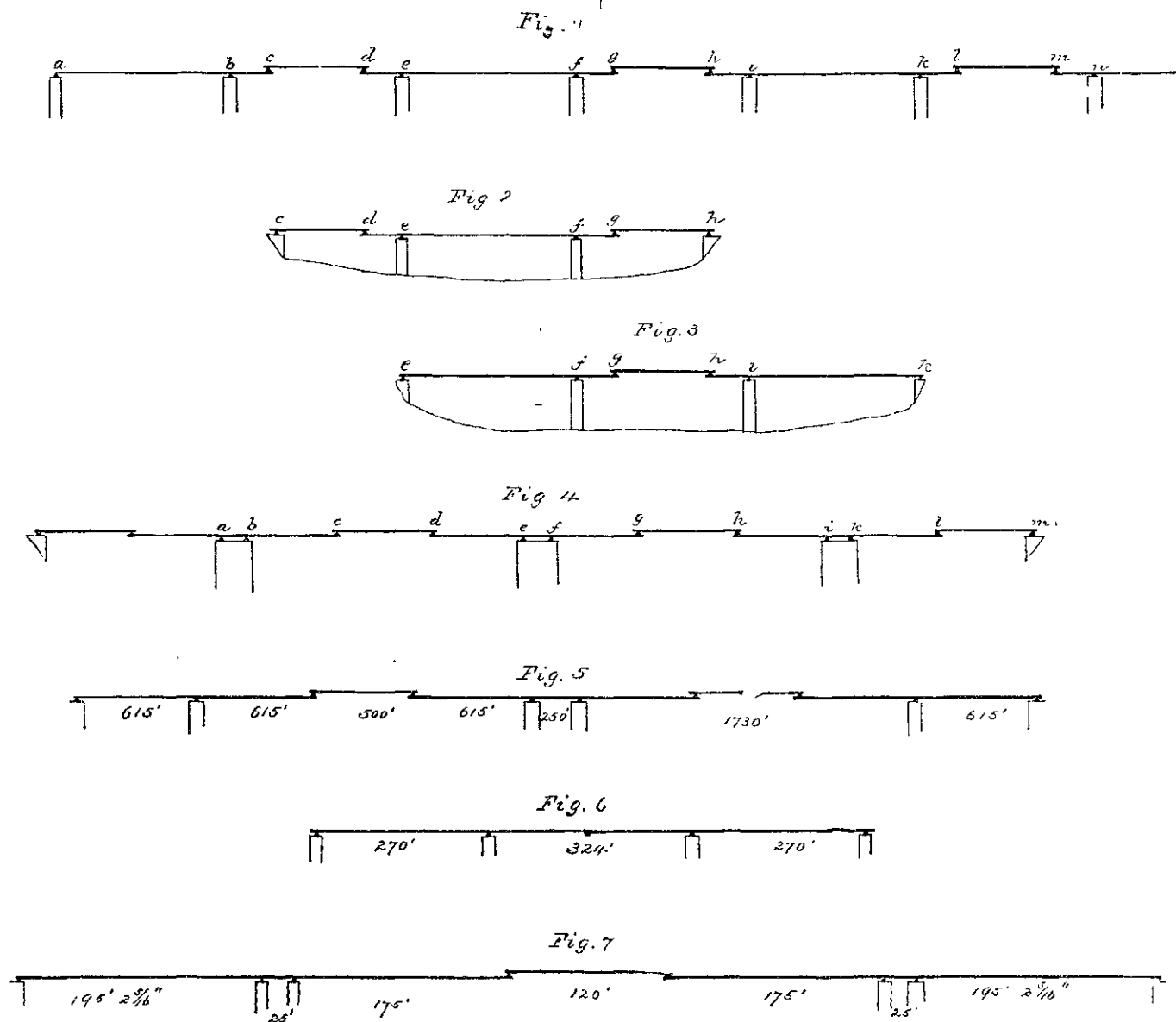
Under these circumstances, engineers have cast about for some form of bridge which should combine the advantages of the continuous girder, as regards quantity of material and ease of erection, without possessing its disadvantages; and they have found the desideratum in the cantilever girder.

The general arrangement of this type of bridge, for any number of spans, is shown in Fig. 1. It consists of a series of cantilevers *dg*, *hk*, etc., projecting beyond their supports, and

carrying between them simple girders, cd , gh , etc. Generally, however, the number of spans taken has been three, in which case we may have two arrangements. The first is shown in Fig. 2, and corresponds to the part ch in Fig. 1, there being a cantilever over the middle span and projecting into the side spans. The second is shown by Fig. 3, corresponding to ck in Fig. 1, there being a cantilever over each outer span projecting into the middle span and carrying a

no change in the forces acting on any of these systems.

Now a few words regarding the history of these bridges. The principle which they involve is by no means new, and many examples may be pointed out which are based upon it. The corbel and lintel combination, found even in the earliest Egyptian and Indian temples, will be recognized by the architects; and many old wooden bridges supported over the piers on



simple girder gh between them. Finally, by diminishing the spans ab , ef , etc., in Fig. 1 so that the two supports of each cantilever come on the same pier, we obtain the general arrangement shown in Fig. 4, in which there is a simple girder in each span. It is clear that this last arrangement requires wider piers than either of the other two, in order to prevent the cantilevers from overturning when loaded on one side; and also that a sinking of a pier will cause

bolsters and inclined struts will be recognized by the civils as involving the idea of Fig. 4 in a rude shape. On the line of the Canadian Pacific Railroad a skeleton bridge was seen rudely built by Indians, and involving the identical principle shown in Fig. 3; while in Thibet there is a bridge of a similar kind built over 200 years ago. In later years various English writers refer to the system, and W. H. Barlow took out a patent in 1859 with reference to that and other

matters. A number of designs were soon after made by English engineers for large bridges on this system, but none of them were built. About the year 1870, however, this type of bridge began to come more prominently into notice, being patented in Germany at about that time by Gerber, a Nuremberg engineer, who, in 1872, built a road-bridge across the Danube at Vils-hofen in Bavaria, with four spans of about 170 feet each, and a centre span of about 212 feet. The same engineer soon afterward built a street-bridge over the Main at Hassfurt, with three spans of about 78, 124, and 78 feet, on the principle of Fig. 3. In 1876 a third large cantilever bridge was built in Germany, over the Warthe, near Posen, consisting of six spans of about 125, 118, 147, 118, and 125 feet. Cantilever bridges have also been built in Germany as plate girders, and in roof constructions, but only for small spans.

In England, the great bridge over the Firth of Forth will, when completed, be the greatest specimen of this type of bridge, and the greatest bridge in existence. It is to consist of two spans of 1,730 feet, and two side spans of 615 feet. Its dimensions are given in Fig. 5, and it will be seen to be essentially the same as the system of Fig. 1.

In our own country the first cantilever bridge was the one built about seven years ago by Mr. C. Shaler Smith across the Kentucky River, on the Cincinnati Southern Railroad. The system is that of Fig. 2, and the length of each of the three spans 375 feet, the cantilever projecting 75 feet over each pier. This bridge is remarkable for its height, the rails being 275 feet above low water. Under just these circumstances the cantilever bridge is most economical, as the cost of erecting a simple girder on scaffolding at such a height would be very large.

Another cantilever bridge is that over the Minnehaha River, near Minneapolis. This, however, is on a little different principle, and is represented in Fig. 6.

The Niagara River bridge is the third large cantilever bridge erected in this country, and by far the largest yet built. Its general ar-

rangement is shown in Fig. 7, and it will be seen to be similar to Fig. 4. The centre simple girder, however, is in reality suspended from the ends of the cantilevers, instead of resting upon them, as indicated. The dimensions are given on the figure. The struts and piers are of steel, while the tie rods are of wrought iron. This great structure is a monument to American engineering skill; and perhaps the most remarkable thing about it is the very short time required to build it, work not having been commenced on the foundation until the middle of April, while the structure was opened to travel on the 20th of December. It was erected by building out from the piers toward the centre, both the side spans having been built on scaffolding. The erection of a simple girder over the centre span would have been impracticable, if not impossible. It is also especially interesting to note that the bridge was designed and built by a former student of the Institute, Mr. Edmund Hayes, engineer of the Central Bridge Works, of Buffalo, who is entitled to the highest credit both for the design and the execution.

G. F. S.

The Study of Biology.

PERHAPS no question is oftener put to a biologist than this, "What is biology?" The answer fortunately is a very simple one, and it is this: physicists and chemists are commonly busy with the study of inorganic, or more strictly, of not-living matter. Biology, however, is the study of living things, of living matter and whatever pertains to living matter pertains to biology. But living matter is found under two forms. It is either plant or animal living matter; so that in another sense biology is botany and zoölogy taken together; these familiar subjects being but the hemispheres of biology.

Practically the biologist proceeds as follows: as it is evidently impossible for him to study all living things, he must try to choose those for study which are more or less typical of large numbers of forms, and in our own laboratory a beginning is made with the yeast plant. This possesses great advantages, as its chemistry and

its physics have been very carefully worked up, and especially because it is a very simple organism. Then comes the study of a simple animal, then of moulds, stoneworts, mosses and ferns, clams, starfishes, earthworms, and frogs; a flowering plant, a bird and a rat, and finally of the embryology of an incubating egg, or of its contained chicken, with which the year's work closes. Afterwards, some special subject in biology, as botany, animal physiology, zoölogy, or embryology, is pursued, according to the taste of the worker.

And the use of all this? Well, biologists are often considered to be visionary, to be chasing some phantom or other, but great minds like Aristotle's have been busy, from his day to Darwin's, and to this,—and have not been ashamed of it,—in chasing the same "phantom." The human breast craves an answer to this great question. How is it that we live, move, and have our being? This alone is a mystery which has been deemed worthy of the noblest steel. But this is not all. To the physician whose heart sinks as he feels his coming defeat in the waning pulse-beat; to the friend whose hope sets with the drooping head; to the officers of the public health, and to many more, biology is more than a phantom. In the germ theory of disease, developed jointly by chemists and biologists, we have a clew to the causes of disease. In disturbed nutrition of the cells of living things we have probably the key itself.

It is for reasons like the foregoing that the faculty of this institution have lately provided a new course (VII-B) preparatory to the professional study of medicine. It is made to include chiefly physics, chemistry, and biology, and of the latter subject especially, animal physiology. This is a young but very thriving science, much cultivated in Germany, where it has had its birth and best development. The biological laboratory of the Institute will be furnished, therefore, not only with microscopes and other tools for work in general biology, but also with kymographs, myographs, tambours, and other physiological instruments of precision for the study of muscle and nerve, of blood pressure,

and of digestion and secretion. In this way it is hoped to send out the student intending to study medicine fully equipped for his work and trained both in mind and hand.

The time is going by and will very soon have gone, when one may enter the medical school fresh from the farm or the factory. He should rather bring to the study of disease familiarity with healthy living things; a hand accustomed to the scalpel and the micrometer; an eye used to the study of cell-life; and a mind stored with the principles of physics, chemistry, and biology. That he may do this will be the endeavor of those who will have his interests in this institution and in the future most at heart.

W. T. S.

Current Literature.

Which might have come from our exchanges.

A "TECH" MEETING REPORTED AFTER THE STYLE OF ONE OF OUR E. C'S.

"The most infernal piece of foolishness I ever heard of," remarked Chubbins as he took a fresh bite off the editorial tobacco. "The idea of having a co-ed. on the board."

The professional poet, who had just come in from the Chapel, brushed the free-lunch cracker crumbs from his sleeve and mildly insisted that he didn't think it was half bad. "That may be," said Chubbins, "but I for one don't want any girls round. Before we knew it they'd have us all swear off on smoking and be publishing a column of 'Golden Thoughts.'"

At this point the office boy came in, and after having been sent out to wipe his feet, returned with the announcement that the printer's collector was waiting outside.

"Well, let him wait," snarled the managing editor, as he caromed into the waste basket, while the P. P.* heaved a sigh which spoke of the oblivion of inspiration. "How are we going to pay him and have a supper at the same time? Tell him to come again during office hours, when he will be sure to find us out."

The painful silence which followed the departure of the office boy was broken by the

* Professional poet.

treasurer, who remarked, "I'll bet a first-rate pair of seventy-five cent shoes that man's outside now laying for us. I move we elect the girl."

"I'd like to know what good that'll do us," returned the P. P. (professional poet), who was idly turning the leaves of the rhyming dictionary; "and, by the way, sir, what became of that last poem I gave you?"

"Lost it down the sewer," said the managing editor. "There is a motion before the house."

"Hang the motion. I'm thirsty: move we adjourn," ejaculated Chubbins; and the prompt and easy manner with which the board went out of the back door to escape the irate collector showed clearly that the motion was carried beyond a doubt.

THE TECH AS OTHERS SEE IT.

The Electrogoniometer.

This valuable instrument which is here for the first time given to the public, was originated in our laboratories, and, although the cuts may look familiar, the invention is entirely new. It relates to a method of accurately measuring such minute quantities of electricity as would be generated by friction through an infinitesimal angle.

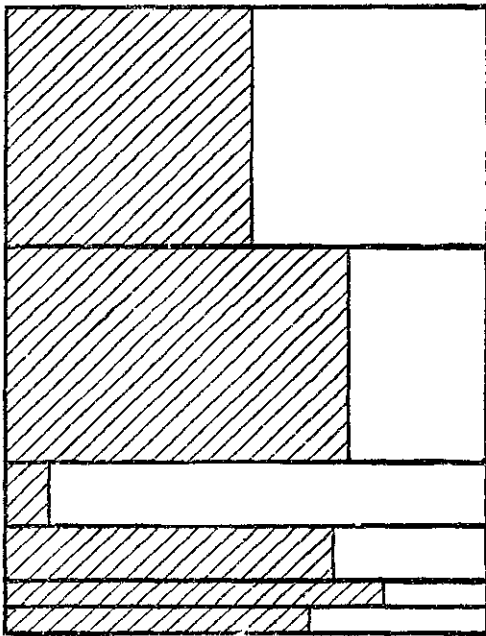


FIG. 2.

In order that the device may be more fully understood, we append two diagrams: Fig. 1 in plan, and Fig. 2 in elevation.

As shown in the drawings, the machine is in three parts. The rod C is movable, and slides longitudinally in a narrow groove. The other two parts are made of the substance whose electricity is to be measured. The rod C is placed in the groove, and the bar *a b* moved through an

angle registered by a vernier at *b*. It will be readily seen that opposite kinds of electricity are generated. The rod C is brought slowly toward *a b* until it is attracted to the latter. The distance through which C moves is the measure of the electricity generated.

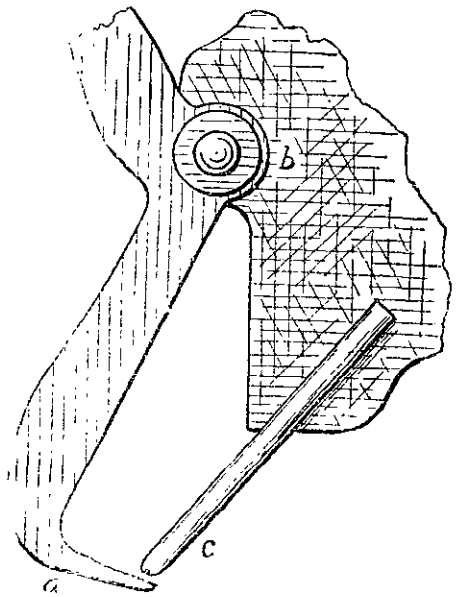


FIG. 1.

The lines of force indicated in the diagram are true only for angles of less than 60° . It can be shown that the distance through which C moves $= \frac{\pi}{2} \times \frac{a b}{\text{wt. of } c} \times \text{the relative specific inductive capacity of the dielectrics}$. This can more easily be deduced from Fig. 2. In this figure the letters x and z should be interchanged.

In our next we will give a *résumé* of the subject of Fast Railroad Trains.

Now is the time to subscribe.

RETRIBUTION.

A merry-jingling sleigh speeds over the frozen road, bearing a young man and woman of noble mould, each in the first exquisite pathos of a love which each knows to be returned. After a moment of silence Reginald de Piercy speaks: "Corisande Arabella Philina! Ah! let me call thee by thy name! Oh! if thou wilt but let me always be to thee as I am now, always at thy side, what bliss is mine. Ah! Corisande Arabella Philina, I love thee!"

Like the rising blush of morn, so is the mantling carmine of her cheek. With a confiding glance in her well-like eyes, she answers: —

"Reginald, by your noble, self-forgetting devotion to my undeserving self, by your generosity during all this winter, I have been conquered, and give unreservedly to thee the heart that has till now been adamantine to all lovers' claims."

Was it the whip that broke the silence with its sharp clang? or was it merely the suction pump that the plumber had inadvertently left on the hydrant?

No, it was not. As Corisande Arabella Philina gurgled a kiss upon his mossy lip her cheek paled, grew hollow at a sudden loss, a dark mass shot forward beyond the dasher, a dull thud was heard upon the icy pavement, — a crash, a moan, and all was still.

As the first gleams of the rising sun gilded the State House dome, they showed two lifeless figures, beautiful in the midst of the wreck about them, — dead in her gum, — her chewing-gum.

Vassar papers please copy.

ALMOST!

On bright June days, when over us the sun
Pours his life-giving beams and warms the world,
We walk together through the sheltered paths,
And with each other share the beauties hurled
In rich profusion at our loitering feet.
The trees above us cast a grateful shade,
As through the wood we slowly wend our way;
The breezes softly fan our cheeks; the leaves
In softly rustling whispers seem to say,
"Come, pause and rest upon this mossy seat:
The evening's calm will soon succeed the day
And the dim light of stars the sun's oppressive heat."

We seat ourselves upon the grassy bank;
I take her hand that trembling lies in mine;
I whisper words of love, so soft and low,
She rather feels than hears. I wait a sign
That will my heart with pain or joy assail.
She sighs and downward looks with half-closed eyes,
And, as I forward lean, a kiss to steal,
I hear a noise that makes me deadly pale.
A well-known form with bull-dog close at heel
Appears from ambush. "Heavens! her pa!" I quail.
A sound of rushing feet, — a bark! — *a bite!!*
A yell! — a jump! and the high fence I scale.
* * * * *
I've been a woman hater since that night.

The First Institute of Technology.

AS the tendency of recent times has been towards the foundation of scientific schools and institutes of technology, perhaps it will be interesting to look back and see what was the first institution of this kind. This was the

Royal Institution of Great Britain, founded by Count Rumford, — one of the most eminent scientists that this country has produced, and one to whom it has done too little honor. Count Rumford's researches had been largely of a practical and technical nature, and in the last part of the last century the idea occurred to him to establish an institution for the diffusion of this kind of knowledge, the outcome of which was the Royal Institution of Great Britain. The conception was entirely original to Rumford, and therefore the credit of founding the first institute of technology belongs to an American.

The purpose of the Institution, in Rumford's words, was "to spread the knowledge of all new and useful inventions, and to teach the application of science to the useful purposes of life." It was to be a repository for models of all kinds of mechanical inventions, and instruction in physics and chemistry was to be given by lectures and a laboratory, which was one of the finest of its time. The funds for the support of the Institution were raised by subscriptions from the members and from fees from those who attended the lectures. The government was intrusted to a board of nine managers elected by the proprietors.

The Institution received its charter in January, 1800, and opened a few months later. Since that time it has been the means of bringing forward many eminent scientists. It was here that Sir Humphrey Davy — who was assistant professor of chemistry and director of the laboratory — won many of his distinctions. Here Faraday received his first instruction in science, and here Dr. Wollaston carried on his experiments in galvanism.

After managing the affairs of the Institution for a few months, Rumford quarrelled with some of the directors, and soon abandoned the scheme altogether. Faraday was for thirty-eight years a lecturer there, and to him a large amount of its success was due.

What town in Connecticut reminds you of the Jewish lawgiver? Why Middletown of course. Leave off the -iddletown and add -oses and you have Moses.

Reunion of Class of '79.

THE Class of '79, M. I. T., held its annual reunion at Young's Hotel on Friday evening, Dec. 28, 1883.

Fourteen members were present, this being the largest meeting of the class since its graduating exercises.

The election of officers resulted as follows:—

President, T. W. CABOT.

Vice-President, F. R. LORING.

Sec. and Treas., H. H. CAMPBELL.

Business Committee, E. G. HARTWELL, F. S. COFFIN, W. H. PICKERING.

After the usual gastronomic exercises, remarks were made by nearly all the members present, and a general discussion was held on various questions concerning the Institute.

(1.) What factors in the intellectual equation shall be considered in determining the fitness of a candidate for a degree?

(2.) To what extent shall physical education be encouraged?

(3.) Is not the School of Mechanic Arts an injury to the Institute?

(4.) What standard of education should be aimed at, and how shall this point be attained?

Upon the first two questions there was diversity of opinion; upon the last two the sentiment was nearly unanimous.

The secretary does not wish, therefore, to communicate anything as the official opinion of the class, but would like to offer, in separate letters, the personal opinions of himself and others as expressed at this meeting, trusting that those holding different views will be heard from, and knowing that a discussion can be productive only of good.

H. H. CAMPBELL,
Sec., '79, M. I. T.

STEELTON, Jan. 4, 1884.

[In regard to the School of Mechanic Arts, a number of men who have been through that school, and come out at the age of seventeen or eighteen, are now holding inferior positions in various iron works, and announcing that they are graduates of the Institute. This, of course, is accepted by those whom they meet, and tends greatly to reduce the value of the real Institute degree. — EDS.]

Communication.

It is a fact well known to all who take an interest in the events of the Institute that, at the end of the last school year, more than one member of the graduating class was refused a degree. It is also known that this refusal was not in all cases caused by failure to pass the required examinations, neither was there proof of dishonest work. That the general character of the students was satisfactory is shown by the fact that they were allowed to complete their full course of study at the Institute without notice that they would not receive the reward for which they had spent their money, their time, and their labor.

That all of them were not deficient in that most valuable of all faculties — business enterprise and ability — is shown by the fact that one of them was the leader in various enterprises at the Institute, and founded and managed THE TECH, which has been since its birth a credit both to the promoters and to the Institute.

Having the fullest confidence in the judgment of the Faculty, the writer must suppose that there was some reason unknown to the public at large and unknown to the classmates of the students in question.

But it must be admitted that, although the power of the Faculty to reject candidates without limit is not open to question, the correctness of any particular decision, from an ethical standpoint or from a consideration of its future results on the reputation of the Institute, cannot be decided by an *ex cathedra* dictum of the powers that be.

The factors in any intellectual equation that determine its value are (1) general integrity, (2) ability, (3) capacity for digging.

That the Institute should insist upon the first admits of no argument. That it should decide upon the relative value of the others before the day of graduation is a consummation devoutly to be wished.

The student with digging capacity, but with little general ability or astuteness, applies him-

self to work, studies two hours on lessons that should be learned in less than half the time, spends his evenings in forcing into his mental system those truths that should have been absorbed in the lecture-room, and, having no time for dissipation or innocent enjoyment, is looked upon by some as a model young man and scholar; he goes forth into the world equipped with formulæ, — physical, mathematical, and chemical, — with books, with tables, and with instruments, and, above all, with that magic wand, a degree, — with everything, in fact, except that one faculty that no digging will ever bring to the surface or Institute confer, — ability.

His fellow, however, blessed with more brains and more ability, finds more time at his disposal, expends his superfluous energy in athletic sports, dances, and other amusements, which, in the eyes of some, are beneath the dignity of an old man of eighteen years, and finds too late that the powers that be frown upon these methods of amusement, and recommend as a source of pleasure the turning of a grindstone, a picture of which useful instrument was carried by the Institute in the political campaign of 1876 to represent the Russian system of education.

Does the Institute fear that it shall recommend men of astuteness who are not workers? Let it also fear that it shall indorse men who are plodders merely.

Let it so construct its examination papers that the ground covered is not that which has been harrowed again and again in the class-room to fit it for slow-growing intellects. Let not the questions be such that judicious examining of certain formulæ and dry data will be reasonably certain to pass the student, as is now too much the case, but let them be of such a character that some original mental effort shall be required in their solution with a comprehension of the principles of the subject.

The older colleges are demolishing what have been called the college fetiches, — the studies of Greek and Latin. Let not the Institute rear new idols in the form of a spade and a grindstone.

STEELTON, Jan. 4, 1884.

H. H. C.

Noticeable Articles.

THE ENGLISH ILLUSTRATED MAGAZINE. (Price, 15 cents.) January. "Matthew Arnold," by Henry James; but the portrait is not good.

Dartmoor illustrated.

CONTEMPORARY REVIEW. January. "Out-door Poetry of the Middle Ages and the Renaissance," by Vernon Lee.

"The Soudan and its Future," by Sir Samuel W. Baker. This is not the Englishman in the service of the Khedive, who is called in the newspapers Baker Pasha, but the distinguished African traveller.

NINETEENTH CENTURY. January. "Religion: A Retrospect and Prospect," by Herbert Spencer. "Amid the mysteries which become the more mysterious the more they are thought about, there will remain the one absolute certainty, that man is ever in presence of an Infinite and Eternal Energy, from which all things proceed."

"Daily Life in a Mediæval Monastery" (with a plan), by the Rev. Dr. Jessopp.

THE GENTLEMAN'S MAGAZINE. January. "The Vehmgericht." See Sir Walter Scott's "Anne of Geierstein." This venerable magazine has reached its *two hundred and fifty-sixth* volume. "Baby's Grandmother," a story which is running in Blackwood, is amusing.

[In the last number the name of the distinguished Belgian economist, Emile de *Laveleye*, was misprinted.]

W. P. A.

List of Publications, M. I. T.

Baldwin, Thos. W. ('76). Annual Reports of the City Engineer and Superintendent of Sewers of the City of Bangor Me., for the years ending March, 1882, and March, 1883. Two pamphlets, 8vo.

Crosby, W. O. ('76). — Probable Occurrence of the Taconian System in Cuba. *Science*, II. (1883), 740.

Howe, H. M. ('71). — Does Alumina act as a base or an acid in singulo silicate slags? *Eng. and Min. Jour.*, Nov. 17, 1883.

Minot, Charles Sedgwick ('72). — Origin of the Mesoderm. *Science*, II. (1883), 815-818.

Wells, Webster ('74). — Plane and Spherical Trigonometry. 1 vol., 8vo. Leach, Shewell & Sanborn: Boston and New York, 1884.

The following titles should have been noticed earlier:—

Class of '77. — List of officers and Class Directory, February, 1882. Circular, pp. 3.

Hyatt, Alpheus (Prof.). — Transformations of Planorhis. *Science* (N. Y.), I. (1880), 138.

Whitaker, Channing ('69). — Three Lectures on Machine Drawing and allied Subjects. *Cotton, Wool, and Iron*, Dec. 23 and 30, 1882; Feb. 20, 1883. [Also reprinted in pamphlet form.]

Department Notes.

Mr. Joseph M. Wade has taken the place of Mr. Thomas Pray, Jr., as editor of *Cotton, Wool, and Iron*, published in Boston, and Mr. M. N. Forney has retired from the *Railroad Gazette*.

The *Mechanical Engineer* refers to our paragraph regarding some trivial accidents in our shops as "a difficulty which attends students in technical colleges."

An Ohio firm manufactures luminous hardware in the shape of harness trimmings, door-plates, match-safes, and fishing bait. By the use of the latter it is claimed that the best game fish can be caught at night. All these articles are coated with phosphorescent paint, which emits light in the dark but by daylight has the appearance of ivory.

Mr. Angus Sinclair has an interesting account in the *American Machinist* of Jan. 5 of how the fastest train in America is run. We differ, however, with Mr. Sinclair as to the propriety of calling the Pennsylvania's Chicago Limited Express the fastest train in America, since, as we have before stated in THE TECH, the New York Central's "Limited" runs a longer distance at a higher average speed, while between Jersey City and Philadelphia there are trains both on the Bound Brook and Pennsylvania routes which beat the latter's "Limited" on that portion of its run which lies between those two cities.

The textile department of the Lowell School of Design having been criticised in *Cotton, Wool, and Iron*, Mr. Scott replies to the criticism in the issue of Jan. 5.

A novel engine has recently been tested on the Eastern Railroad, in which water gas is used as a substitute for coal. The engine weighed about thirty-two tons, with 15-inch cylinder and 24-inch stroke. It was run for one week on a local train, and effected a saving of nearly thirteen dollars in fuel for that time as compared with the amount of coal burned in the same time by the engine which ordinarily drew that train. The engine was used to draw a light train of three or four cars, but was unable to keep exactly on time with them.

6,130 miles of railroad were built in the United States in 1883, as compared with 3,992 miles in 1882, 7,870 in 1881, and 6,139 in 1880.

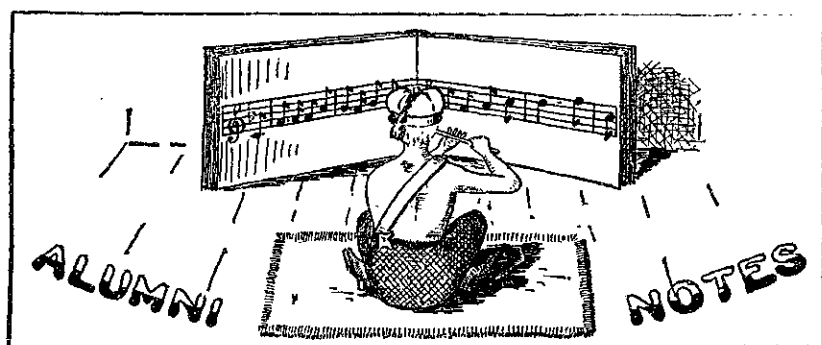
We note the appearance of a new safety cage, with a safety hook which will detach, automatically, the cage from the cable, if drawn up into the sheave. The designer was Mr. Falkenan at the iron works in Leadville, Col., and the large number of mining men present pronounced the device excellent.

The annual meeting of the American Institute of Mining Engineers is to be held at Cincinnati, Ohio, beginning Tuesday, Feb. 19. The members will have an opportunity to enjoy the musical festival, which begins the 10th and continues for two weeks.

The use of natural gas at Pittsburg has not been much of an economical success, but according to late reports it is one in Kittanning, where they have organized a company and pushed the fuel into general use. The well is about two and a quarter miles from the town; the flow is steady and strong, and the company supplies eight hundred fires at a cost of \$8.00 per fire for eight months in the year, — a great reduction on the use of coal.

Several years ago the fourth year miners were re-examined in both mining and mineralogy. Year before last they were obliged to pass an examination in mineralogy. Last year both were omitted, but we understand that '84 is to have another whack at mining before they are cast upon the world. Personally, we favor the holding of an examination in mineralogy, at least, in order to insure the recognition of commercially valuable minerals; and unless one is especially interested in collecting them, he is apt to have forgotten some points learned two years before.

The *Chemical News* speaks in the highest terms of a recently published work entitled "Plant-Analysis: Qualitative and Quantitative," by G. Dragendorff, Ph. D., professor of pharmacy in the University of Dorpat; translated from the German by H. G. Greenish, F. T. C. London: Baillière, Tindall & Cox.



Henry F. Ross, '82, is with Boston Thread & Twine Co., of which Ross, Turner & Co. are the selling agents.

Frank C. Morrison, '82, is in office of Maintenance of Way, P. C. & St. L. R. R., Zanesville, Ohio.

George W. Mansfield, '82, is with Daft Electric Light Co., New York.

Walter B. Snow, '82, is with Sturtevant Blower Co., Jamaica Plain, Mass.

Harry G. Manning, '82, is draughtsman of Boston & Albany Locomotive Shop, Boston.

Prof. Charles Sedgwick Minot, '72, was elected secretary of the Society of Naturalists of the Eastern United States at its last meeting, Dec. 27 and 28.

James S. Atkinson, '81, Colorado Springs, Col. Mr. Atkinson is not at present engaged in active business.

Frank E. Came, '81, Leavenworth, Kansas, secretary of his class.

Frank Cheney, Jr., '82, South Manchester, Conn. Superintendent spinning department Cheney Bros. Silk Manufacturing Company.

H. A. Young, '81, Toledo, Ohio, assistant engineer, T. C. & St. Louis R. R.

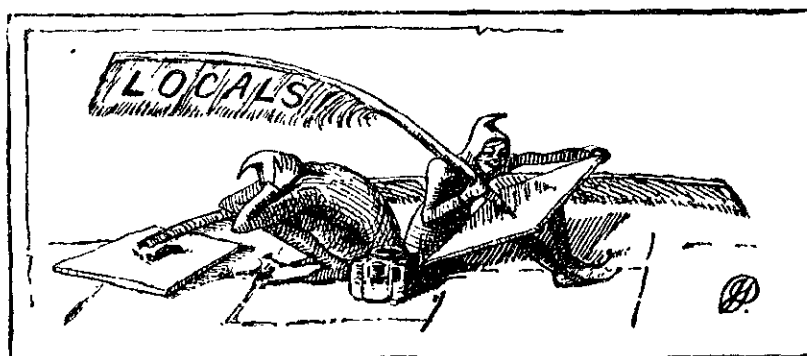
Francis E. Galloupe, '76, No. 317 Marlborough Street, at present engaged in making draughts for an improved rock crusher.

J. W. Revere, '69, No. 40 Commonwealth Avenue, mining expert.

Herbert F. Otis, '84, with Arthur Little, architect, Boston, Mass.

Redington Fiske, '85, in the civil engineering department of the Lowell Railroad.

W. T. Miller, '80, was married to Miss Stanwood at the Shawmut Congregational Church in this city, on Tuesday, Jan. 8.



The Foreign Fair has closed.

The Sophomore chemists have adopted a class pin.

Is the musical society to be carried out as planned?

Several new members have been elected to the 2 G society.

It is about time for the question of class suppers to be agitated.

The Glee Club has discontinued rehearsals until after the recess.

Mr. Smith, '83, and Cabot, '79, were recent visitors at the Institute.

Now a glorious rest of a week and a half, — after a few more examinations.

Many of the students have been enjoying the excellent skating of last week.

The Freshmen are said to be much harder worked than was the class of last year.

The M. I. T. Alumni hold their annual meeting at Young's Hotel Thursday evening.

Profs. Hyatt and Niles attended the meeting of the Society of Naturalists, recently held at New York.

The second-year miners complain of lack of time in which to do their plotting and calculations of surveys.

Mr. George H. Heywood, '84, has gone to Arizona, but expects to return to the Institute early in the next term.

There is a vague rumor that some of the men are getting up a dramatic entertainment, to come off some time next term.

The Senior architects finished the well designs some time ago, and have just handed in the designs for a grand staircase.

Misses Conro and Day have severed their connection with the Institute, and have gone to Europe for an indefinite period.

Prof. Ware, formerly of the Institute, has nearly completed the arrangements to found a scholarship at the Institute for a graduate of the Milton High School.

The class in advanced German took their examination before the semi-annuals had begun, thus relieving them somewhat of the pressure of the past two weeks.

In accordance with the contract with the photographers, those who avail themselves of the '84 class rates will be obliged to sit between the 1st of January and the 1st of April.

'86 has lost two of its members: Mr. I. Z. Smith has gone to Florida to take charge of an orange grove of 200 acres. Mr. Stickney has gone to Europe, and will rejoin his class next autumn.

The annual meeting of the "Laboratory," of the class of '81, took place at the Vendome, Saturday evening, Dec. 29, '83. The reunion called out many pleasant bits of reminiscence, and was thoroughly enjoyed by all concerned.

The Kidder laboratories are the only laboratories in the world where blast and suction are supplied by a steam pump. Prof. Richards's water jet was used in the old laboratories in Rogers's building, but elsewhere the Bunsen pump is mostly used.

It is to be hoped that President Walker will give his course of lectures on Political Economy next term to the students of the third and fourth years. On account of his duties last winter in Washington, the course was omitted, although included in the regular studies prescribed for the third year.

The results of a canvass of part of the class of '86 show interesting figures relative to the manner in which some of its members passed their summer vacation. Of seventy men included in the canvass, forty-seven were at work during the whole or a greater part of the time, fifteen went on "excursions of observation," and two travelled abroad, while six "remained very discreetly at home." The majority of those who worked were engaged in occupations in some way connected with their professional studies.



ATURDAY afternoon, Jan. 12, the Cadets gave their first exhibition drill and dance at the gymnasium. Notwithstanding the unpropitious state of the weather, between eight hundred and a thousand spectators were present.

The drill began at two o'clock, and with Major F. L. Locke commanding, the battalion executed a large number of movements with commendable precision.

After a short rest the adjutant's call was sounded, and line was formed for dress parade, which was gone through with in good form, the battalion presenting a fine appearance with their new uniforms.

At the conclusion of the parade, the officers were marched to the front and centre, and their commissions were presented to them by Gen. Walker. When they had taken their posts, the sergeants marched up and received their warrants, after which the companies were dismissed.

The drill, on the whole, was worthy of praise; and, considering the amount of practice the first term has afforded, gave promise of much excellence in the coming prize-drill next May.

After ranks were broken dancing began, and was continued the remainder of the afternoon, Edmands's orchestra furnishing the music. Major Locke acted as floor manager, assisted by Capt. Edward A. Haskell, Capt. Frank E. Shepard, Capt. Elwood J. Wilson, Capt. Hollon C. Spaulding, Lieut. Albert L. Cushing, and Adjutant Charles D. Underhill.

Though the floor was somewhat crowded, there being fifty-six sets on it at one time, the dancing was enjoyed by all, and the Freshmen are to be congratulated on the success of their first effort.

Now that they are making sugar from beets it is understood that the dead beat was too sweet to live.

The man who asked for an Old Farmer's Almanac was quite exasperated when he found they had sold him one for 1883.

Athletic Notes.

The Base-Ball Association was formed for the purpose of giving the nine a substantial support. This can only be done by having a large membership in the Association. Mr. Twombly, '87, the treasurer, will receive the names of all who desire to join, and we hope that more men will do so than has been the case so far. The expense of providing a suitable place for practice during the rest of the winter will not be heavily felt, if only a sufficient interest shall be shown. The officers, however, have not felt willing to take all the responsibility in this direction.

A request was made about two months ago in THE TECH, that all men who intended to try for the nine should hand in their names at once to some officer of the Association. Up to date only a half-dozen have been received. We are unwilling to believe that these are the only ones who are going to try, and therefore will repeat the notice. All persons who are willing to practise will please hand their names as soon as possible to one of the following: Mr. Sands, '85, Mr. Carleton, '87, or to Mr. Spring, '85. We trust that this request will meet with a more encouraging reception than the other, and also that the treasurer will not find his duties so much of a sinecure. If this is so, the executive committee will feel much more like going ahead in their arrangements for practice.

Wurtz, of the Stevens Institute of Technology, recently kicked a goal from a held free kick at a distance of $174\frac{1}{2}$ feet. This is as accurate kicking as any which was done this season. During the fall Harvard made 132 points to opponents 62. Princeton 241 to opponents 26, Yale 458 to opponents 2, these last being the touchdown made against them by Harvard.

"Umbrellas Recovered" is a sign on Shawmut Avenue. The man ought to do a good business. We have lost four.

All balled up — The codfish, Sunday morning.

Owing to its being leap year, the correct thing in hand-organs will play "Spring, Gentle Spring."

The College World.

YALE. — The crew has been selected and gone into active training.

COLUMBIA. — The college has been presented with astronomical instruments valued at \$12,000.

HARVARD. — In addition to his salary of \$5,000, the president is to receive the benefit of a fund recently invested, but at no time is his salary to exceed \$10,000. — *Columbia Spectator*.

PRINCETON. — Tuition has been raised from \$75 to \$100. — The Faculty have forbidden the reissue of the *Tiger*. Dr. McCosh is an evolutionist.

"The Merchant of Venice" has just been brought out at Oxford, England by the students. Permission has been obtained from the vice-chancellor to perform in public, with the condition that nothing less serious and formidable than Shakespeare's plays shall be attempted.

It is a curious fact that the editors of the *Williams Athenæum* do not seem to have complete control over the matter in their columns. In the last issue it was forced to paste in a notice disclaiming all responsibility for a certain editorial entitled "A Disgraceful Proceeding," in which the writer accuses the '85 men of "stealing the refreshments provided through the president's kindness for the Seniors." If such is a fact we are sorry for '85 (and the Seniors), but if not true our sympathies are certainly with the editors of the *Athenæum* that such slander should by any chance get into their columns.

The study of parliamentary law has been struck out of the *curriculum* by the Bowdoin authorities, and much dissatisfaction is expressed by the students at the action of the Faculty.

The *Williams Argo* says that henceforth the Cobden prizes will be awarded upon the merits of competitive examinations, and that German is to be introduced into the regular work of the Sophomore year.

"The doleful anticipation of those who were destined to spend the Thanksgiving recess in

college *were* unfulfilled." Is it possible that we find a grammatical error in the Vassar *Miscellany*?

Columbia has sent a challenge to Harvard for next spring's boat race.

Columbia is taking steps to introduce the study of the Arabic language.

The editors of the Swartmore *Phoenix* are required to submit to the Faculty all manuscript intended for publication. — *Columbia Spectator*.

Trinity is introducing elective courses into her *curriculum*.

Trinity will receive about \$50,000 by the will of the late Mrs. Northam, widow of the late Col. C. H. Northam. The money will be expended on the college buildings.

The latest educational phenomenon is the University of Texas. The buildings are nearly completed and the university opens this month. The co-educationalist system has been adopted, and forty of the students are women. It has a larger endowment than any other college in America, it amounting to \$5,250,000 and a million acres of land. Columbia has an endowment of \$5,000,000.

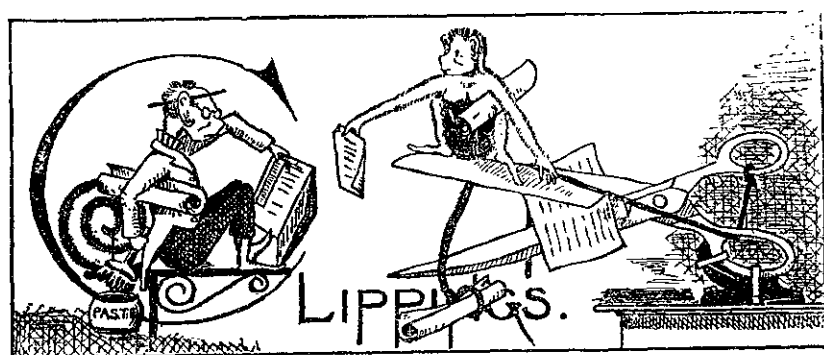
Brown refutes the report which has been going the rounds to the effect that a \$3,000 prize was given to the student passing the best entrance examination in Greek at that college. The truth is, the *income* of \$3,000 is given at the end of the senior year to the person passing best examination in certain prescribed Greek authors.

Princeton, following the lead of other colleges, is working for an "inter-communication" committee.

The *University Magazine* contains a long article, advocating the establishment of a committee, like those existing at Amherst, Bowdoin, and Harvard, for a regular mode of communication between Faculty and students.

At Amherst, valedictories and salutatories are to be abolished for two years, by way of an experiment. — *University Magazine*.

The Base-Ball Association of Brown is in good condition, and hopes to have a strong nine next year.



A big Yankee from Maine in paying his bill in a London restaurant was told that the sum put down did n't include the waiter. "Wall," he roared, "I didn't eat the waiter, did I?" He looked as though he could, though, and there was no further discussion.

The man who is always as cool as a cucumber is generally as green.

Henry VIII. never popped the question; he married his wives first, and ax-ed them afterwards.

When you hear a country choir sing "There will be no more sorrow there," you may conclude there will either not be any singing there or they will not be present to sing.

A man always feels put out when he is taken in.

When a man has no bills against him he feels as though he belonged to the no-bility.

At twenty you know everything; at thirty you have your doubts; at forty there are some things you don't know; and at fifty you are only sure of your ignorance.

A CLEAR TITLE. — If a man would, according to law, give an orange to another, instead of saying, "I give you that orange," the phrase would run thus: "I give you all and singular my estate in interest, right, title, and claim, and advantage of and in that orange, with all its rind, skin, juice, pulp, and all right and advantage therein, with full power to bite, cut, suck, or otherwise eat the same orange, or give the same away, with or without all its rind, skin, juice, pulp, pips, anything heretofore or hereinafter, or in any other deed or deeds, instruments, of what nature or kind soever to the contrary notwithstanding." Such is the language of lawyers; and it is gravely held by the most learned among them that by the omission of any of these words the orange would not be legally conveyed.

FROM *Life*. — Wife (to husband, who has fallen into bad ways): "John Henry, how could you do such a thing? Every one at the party saw that you were not quite right; every one noticed that you were intoxicated."

Husband: "That's all right. If I'd been quite right, and not 't all 'toxicated, they'd have noticed that too, — jus' same thing, m' dear!"

From *Life*. The big-inning of the end. The one in which the last game is decided.



"Wall, John! did ye ever see the like? Bless me if they don't warm the streets in this new-fangled town." (Fact.)

Mr. Cræsus (to Mrs. C. as they go home from the dinner-party): "Well, after the ladies left we had coffee in cups that (so help me) didn't hold *two teaspoonfuls*! an' I told What's-his-name that gave the dinner that folks call *me mean*, but I never cut things down to such a dashed fine point as that."

A Michigan girl told her young man that she would never marry him until he was worth \$10 000. So he started out with a brave heart to make it.

"How are you getting on, George?" she asked, at the expiration of a couple of months.

"Well," George said, hopefully, "I have saved twenty two dollars."

The girl dropped her eyelashes, and blushing remarked,

"I reckon that 's near enough, George." — *Ex.*

"Yes," said Mrs. Egomoi, "I used to think a great deal of Mrs. Goode; she was always so kind to me; but then I've found out that she treats everybody just the same." — *Ex.*

"Ethel," said the teacher, "whom do the ancients say supported the world on his shoulders?" "Atlas, sir." "You're quite right," said the teacher; "Atlas supported the world. Now who supported Atlas?" "I suppose," said Ethel softly, — "I suppose he married a rich wife."

Artificial oysters are the latest things in deceptions, and numbers of the "manufactured bivalves" are said to be passed off on the Paris public.

A minister was questioning a Sunday school about the parable of the good Samaritan who fell among thieves on the way from Jerusalem to Jericho. Bringing the story to a point, he asked: "Now, why did the priest and Levite pass by on the other side?" A scholar held up his hand. "Well, my boy, why did the priest and Levite pass by on the other side?" "I know," said the lad; "because the man was already robbed." — *Ex.*

A young woman in an Ohio town has married her brother's wife's father. When last seen she was busy with a compass and dictionary trying to study out what relation she was to herself.

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Smith & Stedman,

Men's

— FINE —

FURNISHINGS,

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CANES, ETC.,

— 343 —

Washington Street.

Several of the Senior Civils have done considerable work on their theses. Among the mechanicals, Messrs. Baldwin and Rotch are the only ones who have commenced. They have taken as a subject some locomotive tests, and have applied the indicator to an engine, which the New York and New England Railroad Company has placed at their disposal.

The Director of the Mint estimates that on Oct. 1, 1883, the total coin circulation of the United States was, for gold, \$544,512,699, and for silver, \$235,291,623.

BOSTON UNIVERSITY.—A new building is being built for the Law School. It is to cost \$65,000.

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FOR THE

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THIS school of industrial science was opened in February, 1865. The first class graduated in 1868. The school is devoted to the teaching of science as applied to the various engineering professions: viz., civil, mechanical, and mining engineering, as well as to architecture, chemistry, and natural history, physics and electrical engineering, and metallurgy.

Besides the above distinctly professional courses, the Institute offers scientific courses of a less technical character, designed to give students a preparation for business callings. A four-years' course in biology, chemistry, and physics has been established, as preparatory to the professional study of medicine.

Modern languages are taught so far as is needed for the ready and accurate reading of scientific works and periodicals, and may be further pursued as a means of general training.

The constitutional and political history of England and the United States, political economy, and international law are taught, in a measure, to the students of all regular courses.

Applicants for admission to the Institute are examined in English grammar, geography, French, arithmetic, algebra, and geometry. A fuller statement of the requirements for admission will be found in the catalogue, which will be sent without charge on application.

A clear admission paper from any college of recognized character will be accepted as evidence of preparation, in place of an examination.

Graduates of colleges conferring degrees are presumed to have the necessary qualifications for entering the third-year class in any of the regular courses of the Institute, and will be so admitted provisionally, on the presentation of their diplomas.

The feature of instruction which has been most largely developed in the school is laboratory training, shop-work and field practice, to supplement, to illustrate, and to emphasize the instruction of the recitation and lecture room.

Surveying instruments are provided for field work in civil and topographical engineering. Extensive shops have been fitted up for the use of both hand and machine tools; and a laboratory of steam engineering has been established as a part of the instruction in mechanical engineering. Several steam boilers and steam engines of various types are available for experiments and tests. The department of mining engineering and metallurgy has the use of laboratories in which the milling and smelting of lead, copper, silver, and other ores, in economic quantities, are regularly performed by the students themselves. The classes in architecture supplement the work of the drawing and designing rooms by the examination of structures completed or in course of erection, and by practical experiment in the laboratory of applied mechanics, testing the strength of materials and working out problems in construction. The Kidder Chemical Laboratories, just completed, contain desks for four hundred and twenty-six students, and afford the best modern facilities for the study of general, analytical, and organic chemistry. The Rogers Physical Laboratory has been greatly extended in every department during the past year, especially in respect to facilities for instruction and research in electrical science.

On the successful completion of any one of the four-year courses of the Institute, a degree of bachelor of science will be conferred. The Institute is also empowered to confer the degree of doctor of science. Special students are allowed to enter special divisions of any of the courses, on giving evidence that they are prepared to pursue with advantage the studies selected.

The Institute of Technology, as a recipient of a portion of the United States grant to colleges of agriculture and the mechanic arts, gives instruction in military tactics.

The fee for tuition of students taking the full course is \$200 a year. Besides this, \$25 or \$30 are needed for books and instruments. There are no separate laboratory fees. Only payment for articles broken is required.

Attached to the Institute are also two special schools: viz., the "School of Mechanic Arts," and the "Lowell School of Industrial Design." The former gives a training in the use of tools, together with elementary mathematics and drawing. English, French, and geography are also taught in this school. The fees for tuition are \$150 a year. The Lowell School teaches the making of designs for prints, carpets, wall-papers, laces, gingham, and other woven goods. A weaving department with a variety of looms is connected with this school. No charge for instruction is made.

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The chemists and miners of the fourth year in grateful remembrance of the many good offices of Mr. F. S. Pearson, formerly assistant to Prof. Nichols, will be glad to hear that he has been appointed Walker special instructor at Tufts College.

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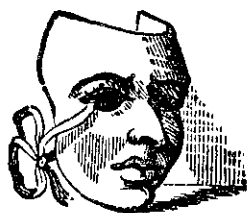
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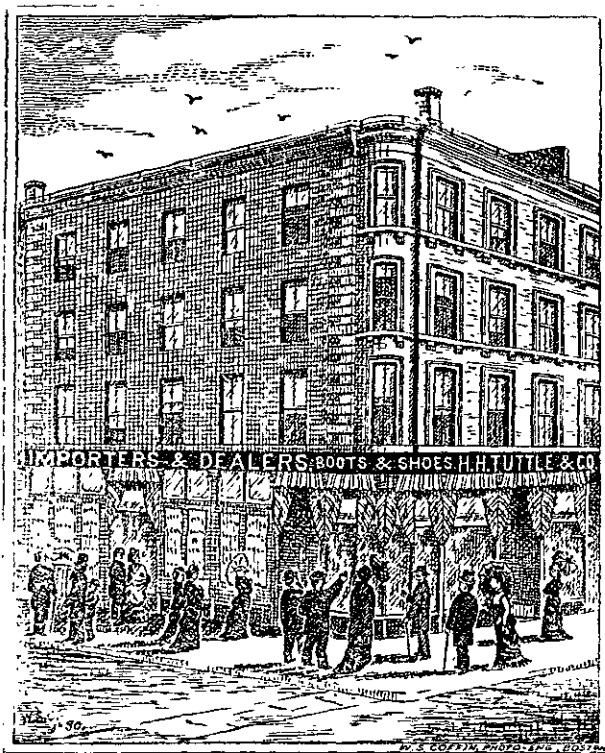


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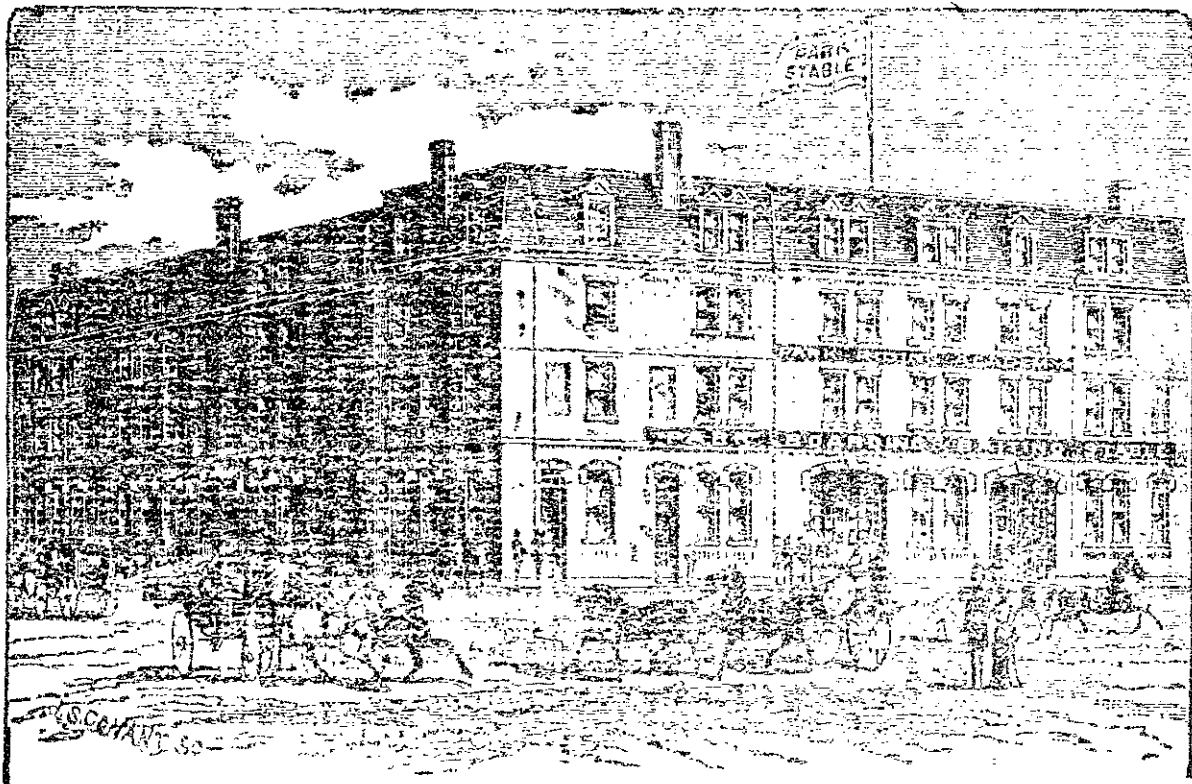
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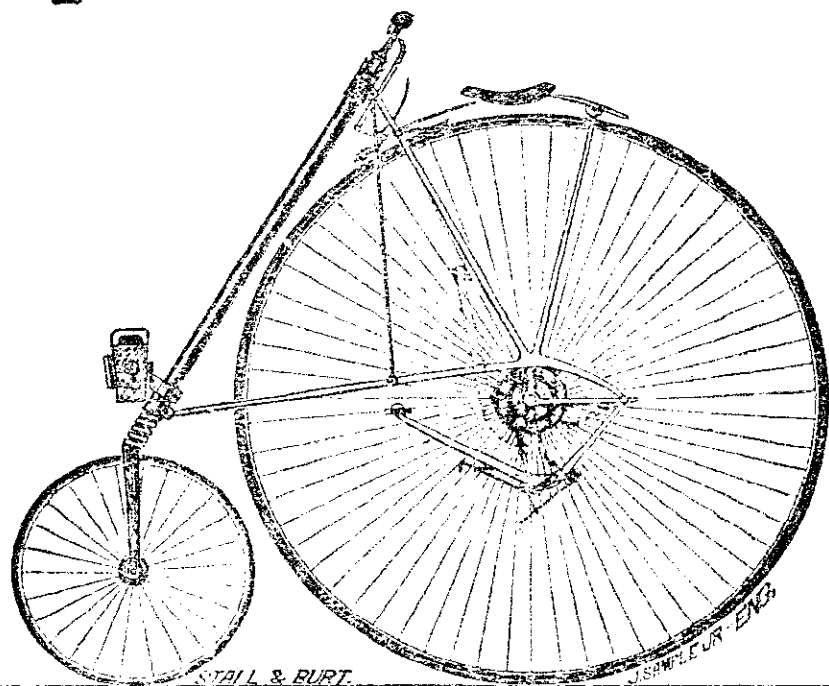
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